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PRC

October 16, 1995

Ms. Teresa Bernhard
Engineering Field Activity, West 1831.1
900 Commodore Drive
San Bruno, CA 94066-5006

Subject: **Transmittal of the Navy Response to Comments on the Draft RI/FS Aquifer Testing Work Plan, Naval Air Station, Alameda**
Navy CLEAN Contract No. N62474-88-D-5086, Contract Task Order 0316

Dear Ms. Bernhard:

Enclosed are five (5) revised copies of the Navy's Response to Comments on the Remedial Investigation/Feasibility Study Aquifer Testing Work Plan, Draft, Naval Air Station (NAS) Alameda, dated April 11, 1995. These copies incorporate your comments of October 11, 1995. The responses to comments have been delayed while waiting for U. S. EPA to comment. As per your direction in late September 1995, we have completed responses to just DTSC and RAB comments. Upon approval of these responses, the work plan will be finalized.

If you have any questions, please call me at 916/853-4507.

Sincerely,
PRC Environmental Management, Inc.

for Susan Willoughby
Project Manager

encl 5

cc: Duane Balch, PRC Sacramento
Scott Bie, PRC Sacramento
Paul Frankel, PRC Seattle
Tong Li, PRC Seattle

RESPONSES TO REGULATORY AGENCY AND COMMUNITY COMMENTS REMEDIAL INVESTIGATION/FEASIBILITY STUDY AQUIFER TESTING WORK PLAN NAVAL AIR STATION, ALAMEDA

The following present the Navy's responses to comments on the Remedial Investigation/Feasibility Study Aquifer Testing Work Plan dated April 11, 1995. Comments were received from the State of California Environmental Protection Agency Department of Toxic Substances Control (DTSC), the California Regional Water Quality Control Board (RWQCB), and the Restoration Advisory Board (RAB). The comments are presented verbatim in italic typeface, and Navy responses are presented in normal typeface. Upon approval of these responses, comments will be incorporated into the final work plan.

RESPONSE TO COMMENTS FROM DTSC ON DRAFT REMEDIAL INVESTIGATION/FEASIBILITY STUDY, AQUIFER TESTING WORK PLAN NAVAL AIR STATION ALAMEDA

Comments by DTSC (Geological Services Unit, Michelle Renbaum), Dated May 19, 1995

INTRODUCTION

Comment: *Per your request I have reviewed the Aquifer Testing workplan for the Naval Air Station Alameda (NAS Alameda), prepared by PRC Environmental Management, INC., and Montgomery Watson, dated April 11, 1995. The objective of the aquifer testing program is to collect data for evaluation and design of a groundwater extraction system. In order to effectively meet this objective, I recommend re-evaluating the locations and well construction design for the proposed pumping wells. The proposed pumping wells for Site 1, 2, and 5 (M-031-E, M-105-A, and M-05-010), are only screened within a portion of the first water-bearing zone. It is recommended by Driscoll, 1986, that for pumping wells the entire thickness of the aquifer should be screened, otherwise assumptions used in equations for determining well yield must be corrected to account for partial penetration of the aquifer. DTSC recommends the use of properly designed wells for both pumping and observation as discussed in our technical guidance (Aquifer Testing for Hydrogeologic Characterization, 1994). Pumping wells should be placed closer to the areas of contamination, so they could be used as extraction wells in the future, if needed. Some of the existing wells could be suitable as observation wells if pumping wells are relocated as shown on the attached figures. Most of the existing wells are constructed in clusters ("A" wells -- screened in the upper water-bearing zone and "E" wells -- screened in the lower water-bearing zone). Additional observation wells (piezometers) screened similar to the pumping well may be required.*

NAS Alameda is underlain by a heterogenous assemblage of sediments: estuarine, alluvial, eolian, mud, and artificial. The artificial fill is the focus for the aquifer tests which consists of dredge spoils hydraulically placed from the surrounding San Francisco Bay. The artificial fill ranges from clays to gravels arranged in irregular lenses. Sand and silty sand predominates the unit. The hydraulic conductivity of the

artificial fill will vary widely depending on type of material encountered in the borehole. Any future extraction well, therefore, will need to undergo similar aquifer tests (pump tests) as presented in this workplan in order to properly design the groundwater pump and treat system. It appears more technically sound and cost effective to conduct pump tests during the remedial design phase. A more thorough discussion should be provided on the objectives and rational for the pump tests. I suggest that more slug tests are conducted in Site 1 and 2 instead of pump tests. Also, a discussion should be provided about recharge from the bay and effects the boundary conditions may have on the pump tests. Please provide the reference material used from Lohman, 1972.

Response: One of the objectives of this aquifer test is to evaluate the appropriate design for future groundwater extraction systems; other objectives include the collection of hydrologic data needed for fate and transport modeling efforts, and data to enhance the Hydrogeological conceptual model for NAS Alameda. An expanded discussion of the objectives of these aquifer tests will be provided in the final work plan.

We agree that the pumping well design should be reevaluated, and this is discussed briefly in the following paragraph. However, we prefer, for this aquifer test, to position the wells in the least contaminated region of groundwater so as to not draw in elevated levels of impacted groundwater. This will also prevent us from having to either dispose of contaminated water, or to pretreat the water, and then dispose it.

The pumping wells originally proposed in the draft RI/FS aquifer testing work plan may not be effective in creating adequate drawdown of the water table. The proposed well design has been reevaluated using the 2-dimensional model, Flow Path 5.1. The revised proposed well design proposed for this aquifer test will be presented and the proposed well locations are shown on Figures 2-1, 2-2, 2-3, and 2-4 attached to this response document.

Pumping tests rather than slug tests were selected because slug tests stress only a small portion of the aquifer adjacent to the well, and therefore are incapable of evaluating Hydrogeological boundary conditions, hydraulic anisotropy, storage coefficients, and pumping characteristics of wells. These parameters are necessary for the evaluation of remedial alternatives at NAS Alameda, and to develop the conceptual Hydrogeological model. In addition slug tests are not useful for predicting steady-state drawdown resulting from any given hypothetical pumping scenario.

Data will be collected in the field (piezometer and monitoring well data) so that interpretation of boundary effects from tidal influence may be interpreted during data evaluation.

SPECIFIC COMMENTS

Comment 1: *Section 1.4, Hydrogeology in the Area of NAS Alameda. Geologic cross sections should be provided to support statements made in this section. Groundwater elevations for both the confined and unconfined aquifers should be indicated on the cross sections.*

Indicate water table and potentiometric surfaces. All groundwater elevation data collected to date should be provided for all wells on Sites 1, 2, 5 and 13. Contour maps should also be provided for groundwater elevations for each monitoring period for all site areas discussed in this workplan. Well logs for all proposed pumping wells, observation wells and background monitoring wells discussed in the workplan should be provided.

Response 1: The final work plan will include the appropriate site specific cross sections and potentiometric surface maps. In addition, well construction diagrams for proposed pumping and well logs for observation wells will be provided. Groundwater elevation data for all wells located at Sites 1, 2, 5, and 13 is provided in two separate reports recently provided to DTSC; those are the "Remedial Investigation/Feasibility Study Data Transmittal Memorandum for Sites 4, 5, 8, 10A, 12, and 14" (PRC 1994), and the "Remedial Investigation/Feasibility Study Data Transmittal Memorandum for Sites 1, 2, 3, Runway Area, 6, 7A, 7B, 7C, 9, 10B, 11, 13, 15, 16, and 19" (PRC 1995). We will also provide a table of this data in the final work plan. For this aquifer test, potentiometric maps showing the most recent groundwater elevations and gradient will be provided; however, seasonal variations in gradient will be accounted for in well placement.

Comment 2: *Section 1.5, Tidal Influence. In order to review tidal influences in water levels from both the first and second water-bearing zones, all groundwater elevation data from the Tidal Influence Study should be provided. Figure 1-10 is missing water level data for M-021-B and M-025-B. See comment number 6, for a more detailed explanation.*

Response 2: Tidal influence studies done previously are presented in the "Data Summary Report Background and Tidal Influence Studies and Additional Work at Sites 4 and 5 Draft Final" (PRC and JMM 1991), and the "Solid Waste Water Quality Assessment Test and Data Summary Report for RI/FS Phases 5 and 6, Final" (PRC and Montgomery Watson 1993). The requested tidal information is voluminous, and to include it with this work plan is not feasible. Please refer to the above reports which were provided to DTSC. However, the aquifer test work plan does include average water levels for all wells included in these tidal influence studies (see Figures 1-10 and 1-11). Monitoring well M-021-B and M-025B were not included in the tidal influence study and are therefore not shown on the figures.

Comment 3: *Section 2.1.1., Design of Aquifer Tests at Site 1 and Site 2. Please provide all data, calculations and results from the slug tests previously performed on the proposed pumping well (M-105-A), or any other wells on site. The slug test data should be included in an appendix to this workplan along with the well logs. A geologic cross section should be prepared through the area of M-105-A. Please provide the reference material used from Lohman, 1972, for placement of observation wells at distances of 1.5, 2.5, and 4 times the aquifer thickness. Please provide the reference for locating the observation wells at distances of 5, 20, and 60 feet downgradient of the pumping well. All piezometer locations should be indicated on a figure. Please provide all*

design and construction details for the proposed piezometers. DTSC's technical guidance document "Monitoring Well Design and Construction for Hydrogeologic Characterization, 1994" is available for assistance.

Response 3: The volume of all data, calculations, and results from slug tests previously performed at wells on site is significant, and it is not practical to include it as part of this work plan as requested. Please refer to the two reports identified in Response 2. However, results from slug tests for proposed observation wells will be provided in the work plan.

Placement of observation wells are proposed at distances of 5, 20, and 60 feet, rather than the prescribed distances following Lohman (1972); this is based on the anticipated low permeability (k) of the first water-bearing zone at NAS Alameda, as indicated from slug tests and geologic information recorded during well installation. The piezometer locations selected reflect the results of modeling (Flow Path 5.1); low hydraulic conductivities assumed for these aquifer test sites resulted in a somewhat steep drawdown cone and a relatively smaller radius of influence. Based on the model for each of the sites, it has been determined that the drawdown effects of pumping would not be detected at observation wells placed at the farthest distances recommended by Lohman. Therefore, the distances between the pumping well and observation wells will be reduced from those suggested in Lohman (1972). Results from the Flow Path 5.1 model will be provided in the final work plan. The well distances referenced in Lohman (1972) are intended for use as guidance and the site-specific hydrogeology should always be evaluated to determine the final placement of observation wells. Piezometer locations and construction diagrams will be provided in the final work plan. DTSC's guidance manual, Monitoring Well Design and Construction for Hydrogeologic Characterization, Interim Final (1994), has also been reviewed during preparation of the work plan.

Comment 4: *Page 2-3, last paragraph. On which wells were the Bouwer and Rice in-situ permeability tests (slug test methods for unconfined aquifers) performed? Which wells were used for determination of the horizontal hydraulic conductivity for both the first and second water-bearing zone? All data and calculations used to determine hydraulic conductivity should be provided (see comment number three). Assess the impact of vertical gradients on Sites 1 and 2.*

Response 4: A new table (Table 2-3), identifying wells where in-situ permeability tests were performed during slug testing, will be included in the work plan. This table also identifies the wells used for determination of hydraulic conductivity of the first and second water-bearing zones. Please refer to the documents identified in Response 2 for requested slug test data.

Presently, available information is inadequate to assess the impact of vertical gradients at Sites 1 and 2. Information gathered during the aquifer test from observation wells screened in deeper portions of the aquifer will provide additional information regarding vertical transmission of groundwater between various water-bearing zones.

Comment 5: *Page 2-5, first paragraph. The proposed pumping well number M-031-E is only screened in the bottom portion of the first water bearing zone. The entire length of the aquifer should be screened (zones A through E). For minimum optimal distances for placement of observation wells see recommendations in Driscoll, 1986.*

Response 5: The well will be designed so that the well screen spans 70 to 80 percent of the saturated thickness. This allows for 90 percent of the maximum yield that could be obtained if the entire saturated thickness were screened (Kruseman and De Ridder, 1991). The entire saturated thickness will not be screened, because there is the potential for drawdown to expose the screened interval.

We would like to clarify that wells placed in water-bearing zone in the vicinity of well M-031-E were screened either at the top of the water-bearing zone, and called "A" wells, or screened at the bottom of the water -bearing zone, and called "E" wells. There are not separate water bearing zones in this region; rather the single water-bearing unit is approximately 20 feet thick.

Comment 6: *Page 2-5, last paragraph. The complete tidal influence study for M-031-E should be provided in order to compare it to M-027-E, which is proposed to be used as the background well to monitor barometric pressure.*

Response 6: The tidal influence study was completed before monitoring well M-031-E was installed; therefore, no tidal information specific to well M-031-E exists. Available data from wells in the near vicinity of well M-031-E indicate that there is tidal influence in the vicinity of M-031-E.

Comment 7: *Page 2-8, third paragraph. DTSC recommends that for at least 2 days prior to the initiation of the pumping phase of the aquifer test, water levels should be measured and recorded on an hourly basis for all zones anticipated to be monitored during the aquifer test. Barometric pressure should also be monitored. This comment also applies to Sites 5 and 13.*

Response 7: Using electronic data loggers, water levels will be measured and recorded on an hourly basis 2 days before the pumping phases of the aquifer tests begin. This protocol will be described in the final work plan. The measurements will be conducted on selected wells installed in the first and second water-bearing zone. A table will be provided in the final work plan presenting proposed monitoring wells selected for aquifer testing.

Comment 8: *Section 2.1.2, Design of Aquifer Tests at Site 5. Page 2-9, second paragraph. All groundwater elevations contained in the Remedial Investigation Report (RI) including contour maps with groundwater flow direction should be provided.*

Response 8: A table of groundwater elevations will be provided in the final work plan. Also, potentiometric maps showing gradient and groundwater elevations for the most recent elevation survey will be provided in the final work plan.

Comment 9: *Page 2-10, third paragraph. It does not appear that the geologic conditions observed in M-05-01 from the fence diagram are representative of the geology throughout the site area, as the test states. The subsurface geology observed in this well is only similar to M-05-04. Wells M-05-01 and M-05-04 are screened in sand, and silty sand. The individual well logs must be provided to support this statement. Wells M-05-02, M-05-03 and M-05-05 are primarily screened in sand. It is inappropriate to apply aquifer properties obtained in one well to the rest of the site. The hydraulic conductivity will vary widely depending on type of material encountered in the borehole.*

Response 9: Well logs will be provided in the final work plan as requested by DTSC. We agree that the lithology varies across Site 5. However, the intent of the aquifer test is not to test a region that contains consistent geology, but rather, acknowledging the variability, to test the response to pumping. It is understood that the hydraulic conductivity will vary depending on the lithology at the location of the borehole. Taking these factors into consideration, as well as the fact that Building 5 has multiple utility trenches that could cause an effect, we selected the proposed well location.

Comment 10: *Page 2-11, first paragraph. Please provide the reference for locating observation wells at distances of 5, 20 and 48 feet downgradient of the pumping well. Comment number one, above, should also be addressed for this Site. Downgradient directions as referenced in the text can not be identified without providing groundwater contour maps and the raw data upon which they are based.*

Second paragraph. In order for M-05-08 to be used as a background well for recording barometric conditions it should be screened in the same water-bearing zone as M-05-01. Well logs and groundwater elevation data should be provided to support the use of this well. Provide information from the tidal influence study to support recommendations identified in the workplan.

Response 10: Please see Response 1 and Response 3. All piezometers and observation wells will be screened in the same water-bearing zone as the pumping well. We have referenced several sources in developing the placement and screening of piezometers, including Kruseman and De Ritter (1975 and 1991), Driscoll (1986), McWhorter and Sunada (1977), Lohman (1972), and Neuman (1975).

Comment 11: *Page 2-12, first paragraph. A groundwater contour map should be provided with groundwater flow directions (see comment number one).*

Response 11: Potentiometric surface maps will be provided in the final work plan as requested.

Comment 12: *Page 2-13, third paragraph. Provide a figure showing locations of the proposed piezometers. Provide the appropriate text from the reference Lohman, 1972, to support locations of the observation wells. All new wells should follow DTSC's technical guidance document "Monitoring Well Design and Construction for Hydrogeologic Characterization, 1994" (see comment number one).*

Response 12: Piezometer locations are shown on Figures 2-1 through 2-4 attached to this response document, and will be provided on the figures in the final work plan (see also response to comment number 3).

Comment 13: *Page 2-16, last paragraph. Additional wells should be used for recording background conditions as a contingency. There are a number of factors that might affect the aquifer test data including: tidal influence, rainfall, and changes in barometric pressures. DTSC recommends that for at least 2 days prior to the initiation of the pumping phase of the aquifer test, water levels should be measured and recorded on an hourly basis for all zones anticipated to be monitored during the aquifer test. Weather conditions should also be noted.*

Response 13: Factors referenced by DTSC including rainfall and changes in barometric pressure will be accounted for in the selected background well, so additional background wells should be unnecessary. The background well was selected using groundwater elevation and tidal influence information available from the two reports identified in Response 2.

Water level measurements will be collected 2 days prior to the pumping tests using electronic data loggers. Weather conditions, including barometric pressure will be recorded.

Comment 14: *Page 3-2, third paragraph. The pumping rate should be determined according to recommendations by Driscoll, 1986 (see page 556). Driscoll recommends using 5 to 8 different pumping rates each lasting 1-2 hours.*

Response 14: Each step of the step-drawdown test will be run for 1-2 hours, and at least 5 pumping rates will be applied, as recommended by Driscoll (1986).

Comment 15: *Page 3-3, third paragraph. Explain how the pumping rate will be determined. How will the pumping rate be measured and kept constant? How was a pumping rate of 2 gpm determined? What is the maximum pump rate?*

Response 15: Pumping rates will be determined using a flow meter or similar measurement device. Two gallons per minute is the minimum sustainable steady-state flow rate that can be maintained using available pumps. Pumping rates for the step-drawdown test may require adjustment in the field depending on well-specific results.

Comment 16: *Section 3.3, Constant Discharge Test. DTSC recommends that the water level measurements be taken as follows:*

Pumping Well

Time Since Pumping Started (or stopped) in minutes	*Time Intervals Between Measurements in Minutes*
0 - 10	*0.5 - 1*
[10] - 15	*1*
15 - 60	*30*
60 - 300	*60*
1440 - termination of test	*480*

Observation Wells

Time Since Pumping Started (or stopped) in minutes	*Time Intervals Between Measurements in Minutes*
0 - 60	*2*
60 - 120	*5*
120 - 240	*10*
240 - 360	*30*
360 - 1440	*60*
1440 - termination of test	*480*

What is the accuracy of the water level measurements in the observation wells?

Response 16: Water level measurements will be collected using a logarithmic scale as recommended by DTSC. The time intervals listed above will be incorporated within the work plan. We may increase the frequency of measurements taken at the observation wells to collect more "early time" data. For example, we may take measurements at 10, 20 and 60 second intervals. All groundwater levels will be automatically measured using an electronic transducer and Hermit data logger (rather than manual measurements using a solonist water level meter). Instrument specifications for Hermit data loggers reference a ± 0.11 percent system accuracy for Hermit data loggers.

Comment 17: *Page 3-4., Section 3.3.2. Initial water level measurements should be taken "hourly" on all selected wells for all zone anticipated to be monitored during the aquifer test (see comment number 13). This section recommends "twice daily."*

Response 17: Measurements will be collected hourly 2 days prior to the pumping tests.

Comment 18: *Page 3-5., Section 3.3.3. A third water quality parameter be included (pH or turbidity) during the drawdown tests. DTSC's Sampling And Analysis Plan (SAP) guidance should be followed.*

Response 18: Water quality measurements collected during the pump test will include pH and turbidity.

Comment 19: *Page 4-1., Field Procedures. The text states that water generated during the aquifer tests will only be sampled for VOCs. Are there other chemicals of concern (metals, pesticides, semi-volatiles, etc.)? Sites 1 and 2 are in the landfill, what other constituents have been identified in the leachate? Are biological and radioactive wastes possible? A health and safety plan should be prepared for the work to be conducted during the aquifer tests.*

Response 19: Only site-specific chemicals of concern will be analyzed based on previous groundwater analytical results. Previous results have not shown biological or radioactive compounds as chemicals of concern at Sites 1, 2, 5 or 13; therefore, samples will not be analyzed for these compounds.

The existing health and safety plan for remedial investigation/feasibility study activities at NAS Alameda will be adequate for aquifer test activities. The aquifer testing is similar to previous and ongoing well development and well sampling activities conducted under the existing health and safety plan, and previous groundwater data does not indicate that we will find high concentrations of contaminants.

RESPONSES TO COMMENTS FROM MR. WAYNE MAYER RESTORATION ADVISORY BOARD MEMBER ON DRAFT REMEDIAL INVESTIGATION/FEASIBILITY STUDY AQUIFER TESTING WORK PLAN NAVAL AIR STATION ALAMEDA

Comments by Mr. Wayne Mayer, Restoration Advisory Board Member dated May 10, 1995

General Comments

Comment 1: *Was saltwater intrusion considered in the locations selected for pumping wells? It should be added to the list of criteria and discussed.*

Response 1: Tidal influence studies have been performed at Sites 1 and 2 (please see response to DTSC Comment 2). Results of the tidal influence study were reviewed in preparing this aquifer testing work plan. During the aquifer testing, specific conductivity, pH, and turbidity will be monitored to evaluate the impact of tidal influences on the pumped or monitored wells.

Comment 2: *How long prior to testing will the piezometer be installed? How will their locations be determined? What are the details of their proposed construction? This information should be added to the workplan.*

Response 2: There is no specific technical or regulatory requirement indicating when the piezometers should be installed. The location of the piezometers is determined based on preliminary estimation of the radius of influence of the pumping well. The radius of influence is estimated using a 2-dimensional model called Flow Path 5.1. A construction schematic of the proposed piezometers will be included in the final work plan.

Comment 3: *The workplan should include a time line of the activities that are necessary for the completion of the aquifer testing and a discussion of the order and interdependencies of these activities.*

Response 3: A schedule will be included in the final work plan.

Comment 4: *Include the boring logs and well construction details for all existing wells to be used during the pumping test as an appendix; this would be very useful.*

Response 4: The boring logs and well construction details for all existing wells to be used during the pumping test will be included in the final work plan.

Specific Comments

Comment 5: *Page 1-6, Section 1.4. If there are no wells completed in the deeper aquifer, how do you know that there is no contamination present?*

Response 5: As discussed in Section 1.4, the sediments beneath NAS Alameda are subdivided into two aquifers. The shallow aquifer consists of two water-bearing zones (the first and second water-bearing zones). At least four quarters of groundwater samples from Sites 1 and 2 were collected from the second water-bearing zones for chemical analyses. Results of the of the chemical analyses indicate that the groundwater in the second water-bearing zone at these sites is not significantly impacted.

Data on the stratigraphy underlying NAS Alameda indicate that the Yerba Buena Mud unit acts as an aquitard beneath the shallow aquifer base wide, and effectively restricts the migration of groundwater between the shallow aquifer and the deeper aquifer. Therefore, it is unlikely that the groundwater in the deeper aquifer would be impacted by chemicals detected in the first water-bearing zone of the shallow aquifer at Sites 1 and 2. In addition, pending results of four quarters of groundwater from all base wide wells, it is preferable not to penetrate through the Yerba Buena Mud aquitard to prevent the possibility of cross-contaminating the deeper aquifer with impacts from the upper aquifer.

Comment 6: *Figure 1-3.*

- *This figure refers to Appendix E, which was not included in the copy of the report that I reviewed.*
- *Why is the line denoting the bottom of the first water bearing zone darker between M-027-C and M-001-B that it is the M-027-C:*
- *Why don't the stratigraphic units shown on figure correspond in depth with the water bearing zone?*
- *Adding line definitions and the meaning of the question marks to the legend would improve this figure's clarify.*

Response 6: The reference to Appendix E is incorrect and will be removed from Figure 1-3.

The line denoting the bottom of the first water-bearing zone is darker between wells M-027-C and M-001-B than it is south of well M-027-C and should be the same shade. This inconsistency will be corrected in the final work plan. The line definitions and the meaning of the question marks will be added in Figure 1-3. The cross section will also be modified for clarification.

Comment 7: *Figure 1-5. Add the water bearing zones to this figure.*

Response 7: Information on the water-bearing zones will be added to this figure.

Comment 8: *Page 2-8, Section 2.1.1, Paragraph 2. Please add Well Monitoring 105-B to Figure 2-2.*

Response 8: Well M-105-B will be added to Figure 2-2.

Comment 9: *Page 2-8, Section 2.1.1, Paragraph 3. Consideration should also be given to the possibility that Well M-105-a, since it is located at the top of the first water bearing zone, might be pumped dry before adequate stress has been applied to the aquifer to produce analytically significant results at all of the monitoring location. Please add a discussion of this potential problem to the text.*

Response 9: Please see response to DTSC Comment 5.

Comment 10: *Page 2-13, Section 2.1.3, Paragraph 2. Is it appropriate to use only the thickness of the first water bearing zone to locate the piezometers when well MW-OR-1 is screened in both the first and second zones, and the two zones appear to be hydraulically connected across most of the site? This might result in less than optimal placement of the piezometers.*

Response 10: Although well MW-OR-1 is screened through silty sand (fill material) and clayey sand (native material), it is not screened across two separate water-bearing zones. However, we will be installing new pumping wells that will be screened across at least 70 percent of the saturated thickness (please see response to DTSC Comment 5). The piezometers will be constructed across the same screened interval as of the pumping well.

Comment 11: *Page 2-14, Section 2.2. The assumption of the methods with regard to aquifer homogeneity and thickness should be added.*

Response 11: A discussion of appropriate assumptions regarding aquifer homogeneity and thickness will be added into the final work plan.

Comment 12: *Figures 2-1 and 2-2. Add the site borders to each figures.*

Response 12: Appropriate site borders will be added to these figures.

Comment 13: *Figure 2-3. What is the difference between the two symbols shown in the legend for monitoring well and boring location?*

Response 13: There are two symbols used for monitoring wells as well as the boring location. The symbols represent different phases of field work. A clarification on these symbols will be added into the figure.

Comment 14: *Page 4-1, Section 4.2. The more thorough decontamination procedure discussed should be used on all instruments that are used in more than one location.*

Response 14: The more detailed decontamination procedure will be used on all instruments that are used in more than one location.

Comment 15: *Page 4-4, Section 4.5, Paragraph. This paragraph should include a discussion of tidal monitoring procedures.*

Response 15: A description of the tidal monitoring procedures will be included in the final work plan. We will install electronic data loggers at appropriate locations along the bay shore to monitor tidal flux during the pumping tests.

REFERENCES

California Environmental Protection Agency. 1994. Monitoring Well Design and Construction for Hydrogeological Characterization, Interim Final. June.

Driscoll, F.G. 1986. Groundwater and Wells, Second Edition. Johnson Division, St. Paul, Minnesota.

Kruseman, G.P., and N.A. De Ridder. 1975. Well Pumping in Unconfined Aquifers: The Influence of the Unsaturated Zone. Water Resources Res. Vol. 1.

Kruseman, G.P., and N.A. De Ridder. 1991. Analysis and Evaluation of Pumping Test Data. 2nd Ed., Nat'l Institute for Land Reclamation and Improvement/ILRI, Wageningen, The Netherlands.

Lohman, S.W. 1972. Ground Water Hydraulics. U.S. Geological Survey Professional Paper 708.

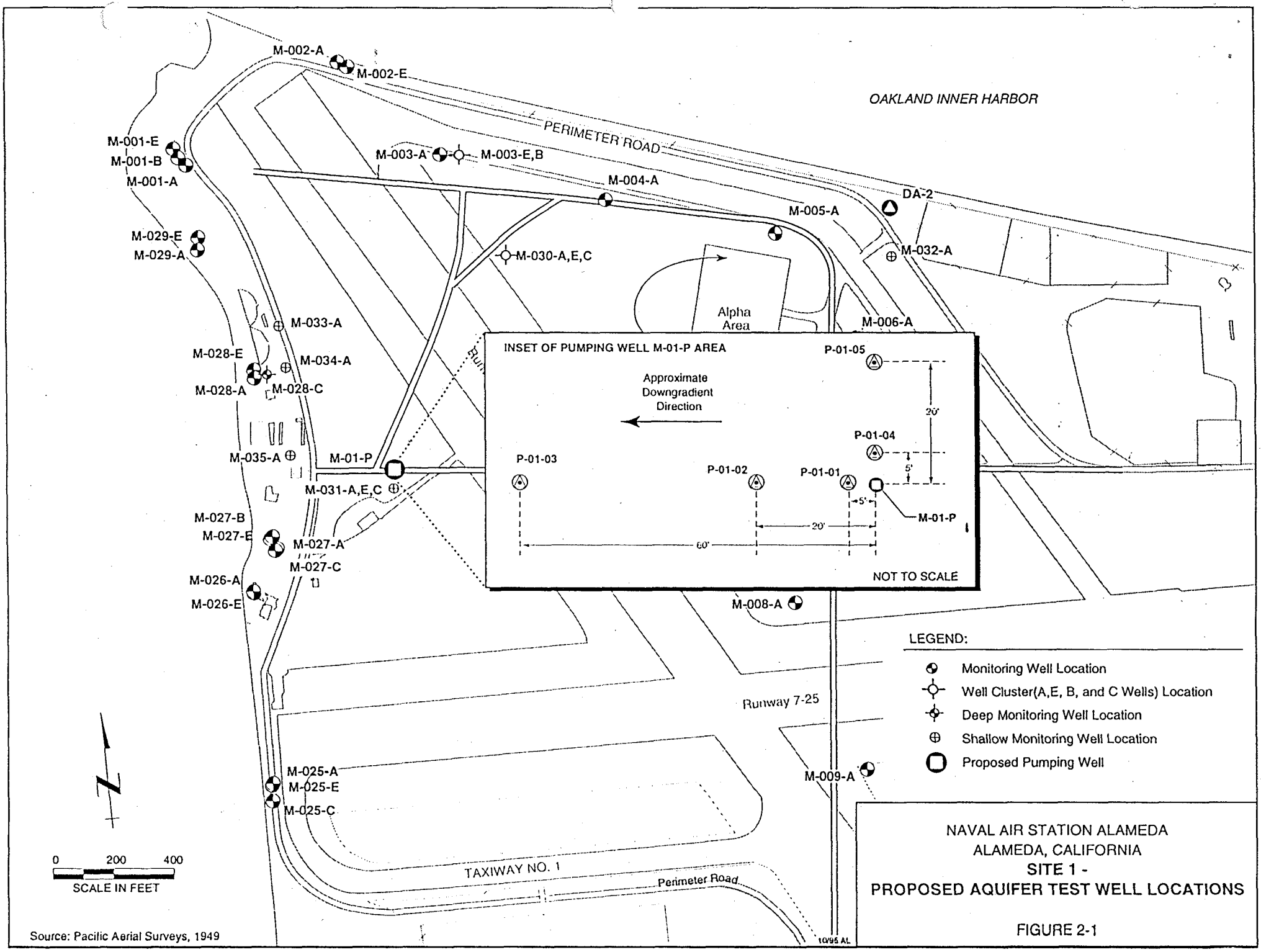
McWhorter D.B., and D.K. Sunada. 1977. Ground-Water Hydrology and Hydraulics. Water Resources Publications.

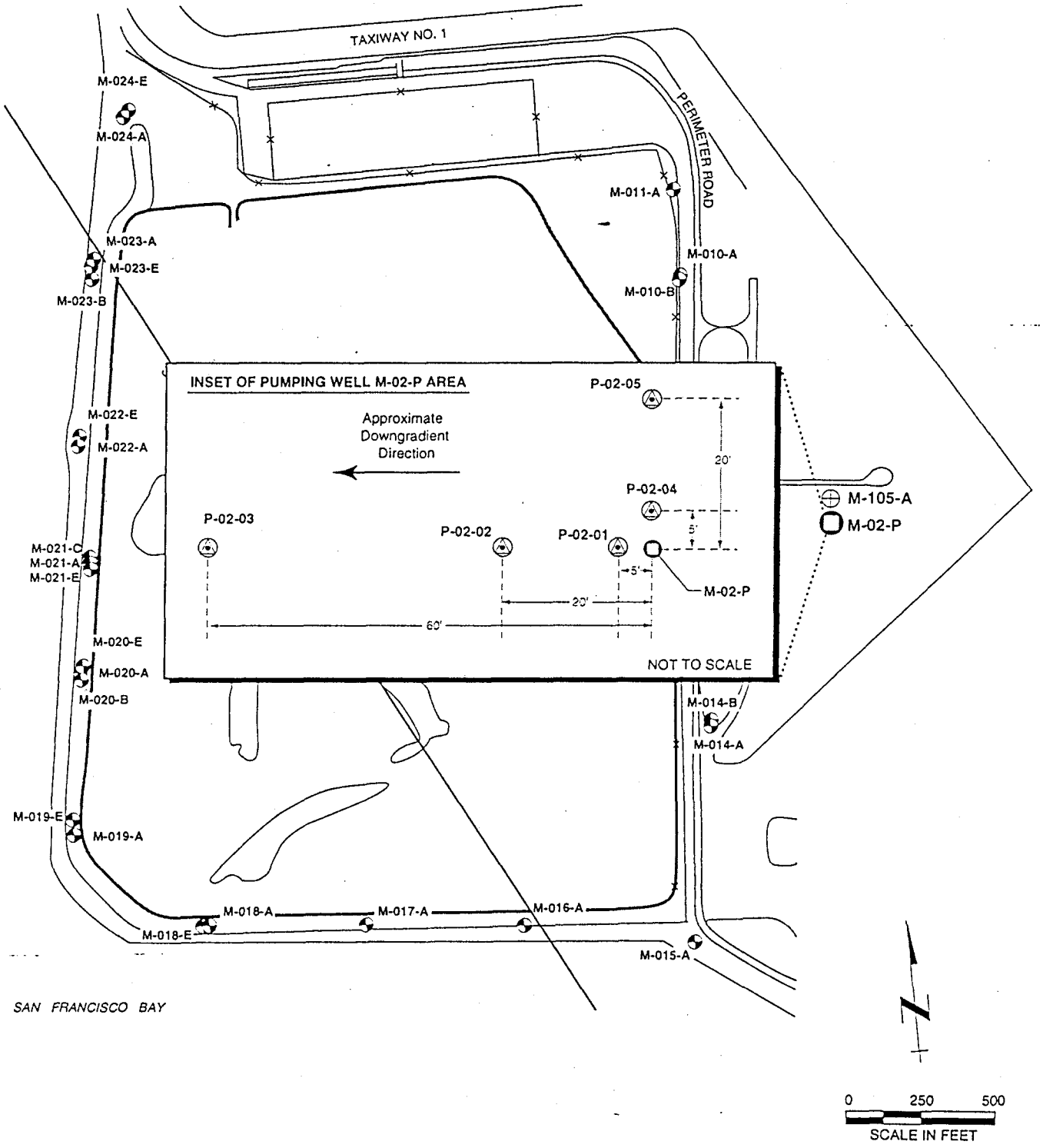
PRC Environmental Management, Inc. (PRC). 1995(a). Remedial Investigation/Feasibility Study Data Transmittal Memorandum, Sites 1, 2, 3, Runway Area, 6, 7A, 7B, 7C, 9, 10B, 11, 13, 15, 16, and 19. Draft. July 11.

PRC 1995 (b). Remedial Investigation/Feasibility Study Data Transmittal Memorandum, Sites 4, 5, 8, 10A, 12, and 14. Draft. January.

PRC and James M. Montgomery, Consulting Engineers, Inc. (JMM). 1993. Naval Air Station Alameda, California. Solid Waste Water Quality Assessment Test (SWAT) and Data Summary Report for RI/FS Phases 5 and 6, Final. April 30.

PRC and JMM. 1992. Naval Air Station Alameda, California. Data Summary Report Background and Tidal Influence Studies and Additional Work at Sites 4 and 5. Draft Final. August 4.


M-002-A
M-002-E
OAKLAND INNER HARBOR
PERIMETER ROAD
M-001-E
M-001-B
M-001-A
M-003-A
M-003-E,B
M-004-A
DA-2
M-005-A
M-032-A
M-029-E
M-029-A
M-030-A,E,C
Alpha Area
M-006-A
M-033-A
M-028-E
M-034-A
M-028-A
M-028-C
M-035-A
M-01-P
M-031-A,E,C
M-027-B
M-027-E
M-027-A
M-027-C
M-026-A
M-026-E
INSET OF PUMPING WELL M-01-P AREA
Approximate Downgradient Direction
P-01-05
P-01-04
P-01-03
P-01-02
P-01-01
M-01-P
20'
5'
60'
NOT TO SCALE
M-008-A
Runway 7-25
M-009-A
M-025-A
M-025-E
M-025-C
TAXIWAY NO. 1
Perimeter Road
LEGEND:
Monitoring Well Location
Well Cluster(A,E, B, and C Wells) Location
Deep Monitoring Well Location
Shallow Monitoring Well Location
Proposed Pumping Well
0
200
400
SCALE IN FEET
Source: Pacific Aerial Surveys, 1949
10/95 AL
NAVAL AIR STATION ALAMEDA
ALAMEDA, CALIFORNIA
SITE 1 -
PROPOSED AQUIFER TEST WELL LOCATIONS
FIGURE 2-1



LEGEND

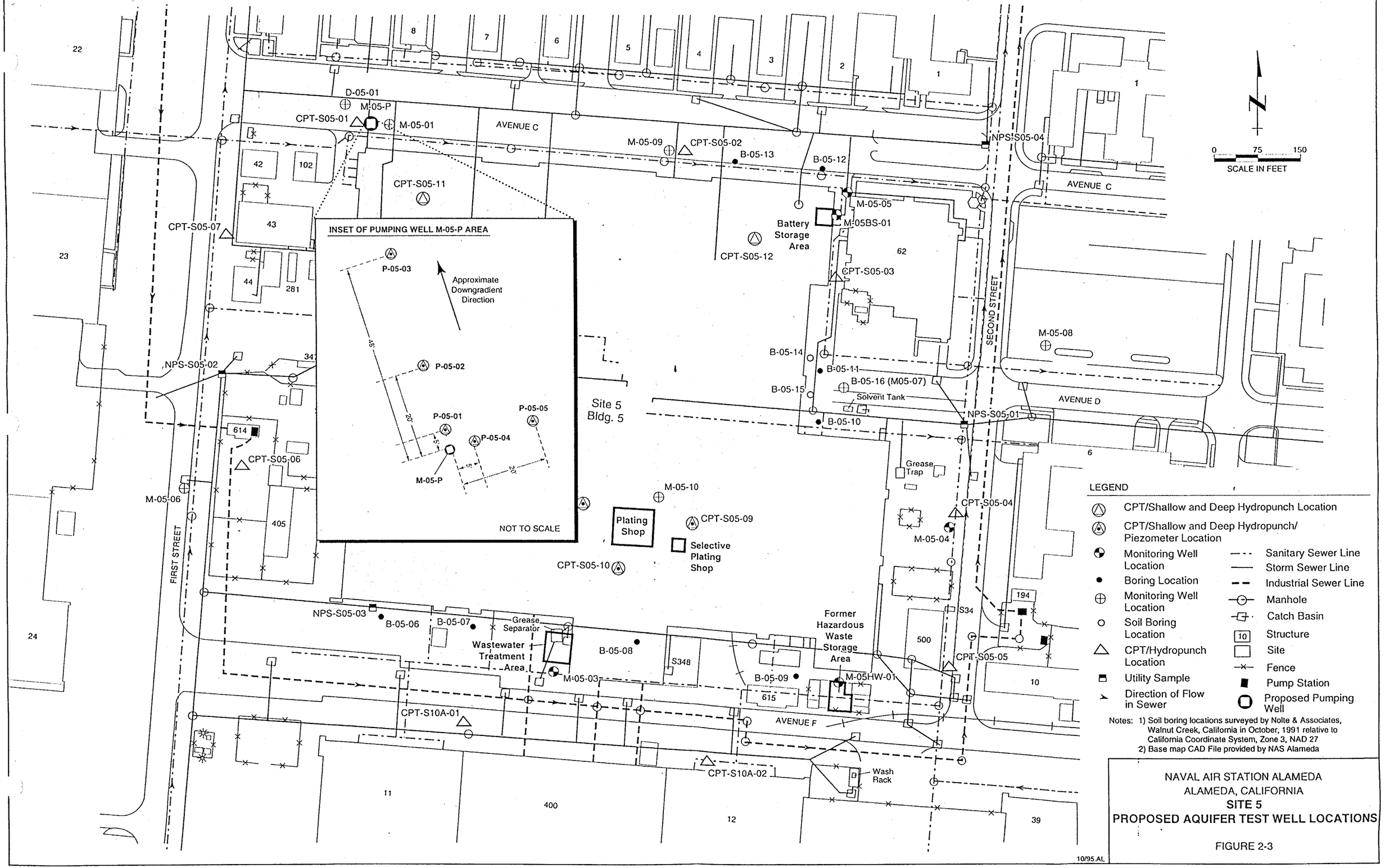
⊕ Monitoring Well Location

O Proposed Pumping Well

NAVAL AIR STATION ALAMEDA
ALAMEDA, CALIFORNIA
SITE 2
PROPOSED AQUIFER TEST WELL LOCATIONS

FIGURE 2-2

10/95.AL


INSET OF PUMPING WELL M-05-P AREA
P-05-03
Approximate Downgradient Direction
45'
P-05-02
20'
P-05-01
P-05-05
P-05-04
5'
5'
20'
M-05-P
NOT TO SCALE
D-05-01
M-05-P
CPT-S05-01
M-05-01
AVENUE C
M-05-09
CPT-S05-02
B-05-13
B-05-12
NPS-S05-04
CPT-S05-11
CPT-S05-07
M-05-05
M-05BS-01
Battery Storage Area
CPT-S05-12
CPT-S05-03
SECOND STREET
M-05-08
B-05-14
B-05-11
B-05-15
B-05-16 (M05-07)
Solvent Tank
B-05-10
NPS-S05-01
AVENUE D
NPS-S05-02
Site 5 Bldg. 5
CPT-S05-06
M-05-06
FIRST STREET
M-05-10
Plating Shop
CPT-S05-09
Selective Plating Shop
CPT-S05-10
Grease Trap
CPT-S05-04
M-05-04
NPS-S05-03
B-05-06
B-05-07
Grease Separator
Wastewater Treatment Area
B-05-08
M-05-03
S348
Former Hazardous Waste Storage Area
B-05-09
M-05HW-01
CPT-S05-05
CPT-S10A-01
AVENUE F
CPT-S10A-02
Wash Rack
0 75 150
SCALE IN FEET
LEGEND
CPT/Shallow and Deep Hydropunch Location
CPT/Shallow and Deep Hydropunch/ Piezometer Location
Monitoring Well Location
Boring Location
Monitoring Well Location
Soil Boring Location
CPT/Hydropunch Location
Utility Sample
Direction of Flow in Sewer
Sanitary Sewer Line
Storm Sewer Line
Industrial Sewer Line
Manhole
Catch Basin
Structure
Site
Fence
Pump Station
Proposed Pumping Well
Notes: 1) Soil boring locations surveyed by Nolte & Associates, Walnut Creek, California in October, 1991 relative to California Coordinate System, Zone 3, NAD 27
2) Base map CAD File provided by NAS Alameda
NAVAL AIR STATION ALAMEDA
ALAMEDA, CALIFORNIA
SITE 5
PROPOSED AQUIFER TEST WELL LOCATIONS
FIGURE 2-3
10/95.AL

LEGEND

- Canonie Soil Boring Location
- Canonie Monitoring Well Location
- HLA Boring Location (Only B-7 Shown)
- HLA Monitoring Well Location
- IMF Site Monitoring Well Location
- Boring Location
- Monitoring Well Location
- CPT/Hydropunch Location
- CPT/Shallow Hydropunch Location
- Proposed Pumping Well
- Utility Sample Location
- Direction of Flow in Sewer
- Fence
- Sanitary Sewer Line
- Storm Sewer Line
- Railroad
- Manhole
- Catch Basin
- Site 7C
- Site 10B
- Site 19
- Site 13

Boring and monitoring well locations were obtained from a base map provided by Canonie Environmental. The individual locations were digitized onto a base map CAD file provided by NAS Alameda.

0 80 160
SCALE IN FEET

NAVAL AIR STATION ALAMEDA
ALAMEDA, CALIFORNIA
SITE 13
PROPOSED AQUIFER TEST WELL LOCATIONS

FIGURE 2-4

10/95.AL